
वस्त्रादि — कपड़े से निकाले गए धागे का
क्रिम्प और रैखिक घनत्व के निर्धारण की
विधि

(दूसरा पुनरीक्षण)

**Textiles — Method for Determination
of Crimp and Linear Density of Yarn
Removed from Fabric**
(Second Revision)

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FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards after the draft was finalized by the Physical Methods Test Sectional Committee and approved by the Textiles Division Council.

Warp and weft yarns interlace in fabric during the weaving stage. They follow a wavy or corrugated path. Crimp percentage is a measurement of this waviness in yarns. Due to this crimp formation in the yarn, the method for determining the linear density of the yarn from a fabric differs from that of yarn from a package.

This standard was originally published in 1966 and subsequently revised in 1980. The present revision has been made in the light of experience gained since its publication and to incorporate the following major changes:

- a) Requirement for the tension to be used to straighten the yarn/thread after removal from the fabric has been specified in Annex C;
- b) Amendment has been incorporated;
- c) Title of the standard has been modified; and
- d) References to Indian standards have been updated.

In the preparation of this standard, considerable assistance has been derived from ISO 7211-3 : 1984 'Textiles — Woven fabrics — Construction — Methods of analysis — Part 3: Determination of crimp of yarn in fabric' and ISO 7211-5 : 2020 'Textiles — Methods for analysis of woven fabrics construction — Part 5: Determination of linear density of yarn removed from fabric'.

The composition of the Committee responsible for the formulation of this standard is listed in Annex D.

In reporting the result of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2 : 2022 'Rules for rounding off numerical values (*second revision*)'.

*Indian Standard***TEXTILES — METHOD FOR DETERMINATION OF CRIMP
AND LINEAR DENSITY OF YARN REMOVED FROM FABRIC***(Second Revision)***1 SCOPE**

1.1 This standard prescribes a method for the determination of crimp and linear density (direct or indirect count) of yarn removed from any textile fabric in which yarns are intact and can be removed in measurable lengths. In case the fabric contains plied or cabled yarn, the method is applicable for the determination of its resultant linear density.

1.2 The linear density of yarn determined by this method may not, however, be expected to agree with the linear density of grey yarn used for weaving the fabric because of the changes brought about in the yarn linear density by the processing treatments as well as the treatments prescribed in this standard for removal of the added matter.

1.3 This standard is applicable to yarns that stretch less than 5 percent when tension on yarn is increased from 0.25 g/tex to 0.75 g/tex. By mutual agreement, it may be adapted to yarns that stretch more than 5 percent by use of pre-tension lower than the specified method for elastomers or use of tension higher than that specified in this method to remove crimp out of textured yarns.

2 REFERENCES

The standards listed in Annex A contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated in Annex A.

3 TERMINOLOGY

For the purpose of this standard, the definitions as given in IS 232 and the following shall apply.

3.1 Crimp Percent — The difference between the straightened length of yarn/thread and the distance between the ends of yarn while in the cloth/fabric, expressed as a percentage of the latter.

3.2 Straightening Tension — The minimum force that, when applied to yarn, removes the crimp caused by weaving (*see* Annex C).

4 PRINCIPLE

4.1 Yarns are removed from a strip of fabric of known length, straightened by a tension that is applied according to the nature and linear density of the yarn and measured in the straightened state. The difference between the straightened length of the yarn and the distance between its ends while in the fabric is expressed as a percentage of the latter.

5 SAMPLING

5.1 Samples shall be so drawn as to be representative of the lot. Samples drawn in accordance with the procedure laid down in the material specification or as agreed to between the buyer and the seller shall be taken as representative of the lot. In case the test is to be performed on small samples of fabrics, care shall be taken to take specimens as representative as possible and it shall be reported in the test report.

NOTE — In the case of cotton fabrics, samples from the lot shall be drawn in accordance with IS 3919.

6 APPARATUS

6.1 A device capable of measuring the straightened length of yarn in a horizontal or vertical direction provided with two yarn clamps/grips, each of which closes at its rear end first and when closed, has parallel gripping surfaces. The distance between the grips is adjustable and through one of which a known tension can be applied. Each clamp shall consist of two jaws, preferably metallic, having parallel gripping surfaces.

NOTE — Any available crimp tester may be used for this purpose.

6.2 Balance — Capable of weighing correct to a milligram.

7 PREPARATION OF TEST SPECIMENS

7.1 From the various portions of the fabric comprising the test sample (**5.1**), cut out strips of five warp way test specimens P_1 , P_2 , P_3 , P_4 and P_5 and five weft way test specimens T_1 , T_2 , T_3 , T_4 and T_5 , taking care that the same group of warp and weft yarns is not repeated (*see* Fig. 1). Each specimen shall be 250 mm long and of sufficient width to yield at least 25 warp or weft yarns/threads per strip.

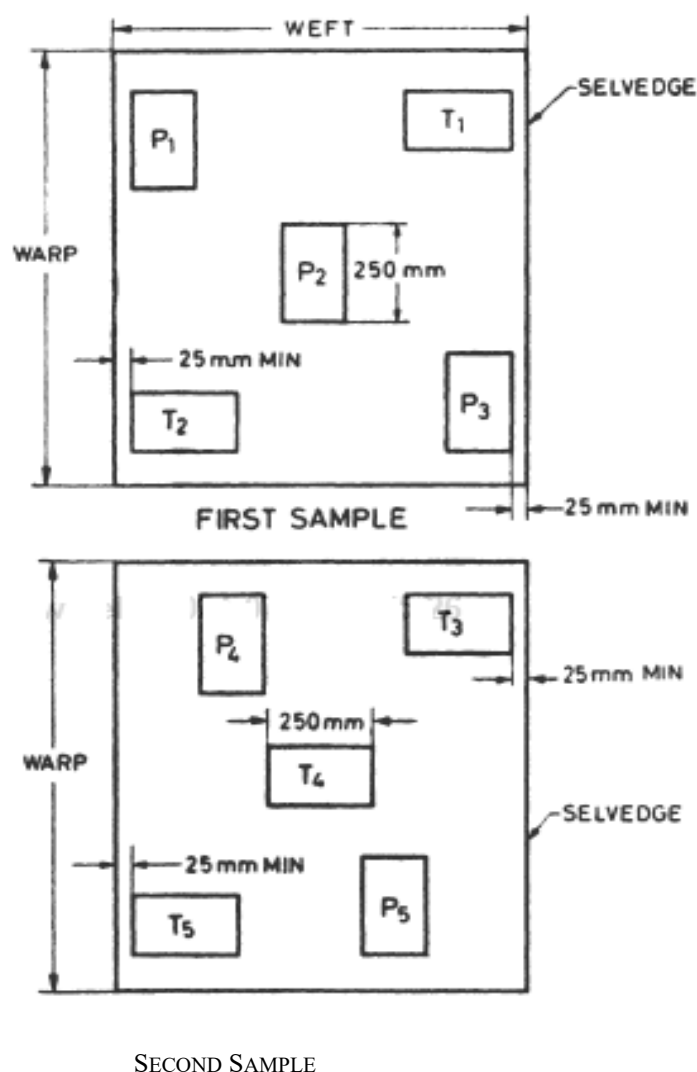


FIG. 1 LAYOUT OF TEST SPECIMENS

8 ATMOSPHERIC CONDITIONS FOR CONDITIONING AND TESTING

8.1 The test specimens shall be conditioned in standard atmospheric conditions of (65 ± 2) percent relative humidity and $27^\circ\text{C} \pm 2^\circ\text{C}$ temperature to moisture equilibrium from dry side (*see* IS 6359) for at least 16 h.

8.2 The tests shall be carried out in standard or alternate atmospheric conditions as agreed to between the parties.

9 PROCEDURE

9.1 Warp Yarn

9.1.1 For determining the approximate universal count of the warp yarn in tex, which is necessary for calculating the tension to be applied during the test, take one of the warp way test specimens. Draw two

parallel marks 200 mm apart at right angles to the direction of warp. Remove 10 warp yarns and cut them along the marks with a sharp razor blade and template. Determine the mass of all the yarns in milligrams and calculate the approximate universal count of the yarn in tex by the following formula:

$$t = \frac{m}{2}$$

where

t = approximate universal count in tex of the warp yarn; and

m = mass in milligrams of 10 warp yarns.

9.1.2 Take the test specimen P_1 and draw two parallel marks 200 mm (l) apart at right angles to the direction of the warp. Ravel a warp yarn out of the test specimen P_1 to a length of about 50 mm. Hold the yarn as close to the end as possible and fasten its loose end in the tension clamp so that one of the

marks on the yarn coincides with the inner edge of the tension clamp. Pull the yarn out of the test specimen sideways, taking care not to stretch the yarn or release the other end of the yarn to avoid the removal of any twist. Hold the yarn as close to the end as possible to avoid any untwisting. Draw the yarn through the other clamp and fix the yarn such that the second mark on the yarn coincides with the inner edge of the clamp. Measure the length of the yarn between the two marks in millimetres under tension as given in Annex C with a ± 10 percent range. (It should be noted that the tex of yarn determined as in 9.1.1 for this purpose is only approximate). In a similar manner, determine the length between the marks of 9 other warp yarns. From the data thus obtained, calculate the average straightened length between the marks (l_1) of 10 warp yarns.

9.1.3 Calculate the crimp percent in the yarn by the following formula:

$$\text{Crimp percent} = \frac{l_1 - l}{l} \times 100$$

where

l_1 = average length in millimetres of the yarns when straightened; and

l = length in millimetres of the yarns while in cloth.

NOTE — The crimp percent may be determined by using a crimp tester, following the procedure as prescribed in the instrument manual.

9.1.4 Cut the test specimen along the marks with a sharp razor blade and template. Remove the sufficient number of warp yarns (*see* Note) out of the specimen so that the total length of the yarns removed is about 10 m, and place them in a suitable container.

NOTE — It may be necessary to trim off the protruding weft yarns frequently to avoid fraying of the warp yarns.

9.1.5 Calculate the total length (L) of the yarns collected in the container in millimetres taking the average length between the marks (l_1) determined as in 9.1.2, as the length of each yarn.

9.1.6 Make the yarns into bundles or loops and remove the finishing material as given in Annex B. Determine the mass (M) of the yarns in milligrams after conditioning (*see* 8.1).

9.1.7 From the data thus obtained, determine the universal count T of the yarn in tex by the following formula:

$$T = \frac{M}{L} \times 1000$$

where

M = total mass in milligrams of the yarns (9.1.6); and

L = total length in millimetres of the yarns (9.1.5).

9.1.8 Determine the crimp and linear density of the warp yarn in the remaining four test specimens, P_2 , P_3 , P_4 , and P_5 in a similar manner. Find the average of the 5 values in each case, round off these values to one decimal place and report the values thus obtained as the crimp percent and count of the warp yarn.

NOTES

1 If it is desired to express the result in any of the traditional count systems, use one of the following formulae as applicable:

$$\text{a) Count in the direct system} = \frac{M}{L} \times 1000 \times C_1$$

where

M and L have the same meaning as in 9.1.7; and

C_1 = a constant corresponding to the count in the direct system in which the result is desired (*see* Table 1).

$$\text{b) Count in the indirect system} = \frac{L}{M \times 1000} \times C_2$$

where

M and L have the same meaning as in 9.1.7; and

C_2 = a constant corresponding to the count in the indirect system in which the result is desired (*see* Table 2).

2 For factors and tables for conversion of yarn linear density from one system to other, reference to IS 3689 may be made.

Table 1 Constants for Direct Count Systems
(Clause 9.1.8)

Sl No.	Yarn Count System	Unit of Mass used	Unit of Length Used	Unit of Yarn Count	Constant C_1
(1)	(2)	(3)	(4)	(5)	(6)
i)	Denier	1 gram	9 000 metres	g/9 000m	9
ii)	Jute	1 pound	14 400 yards (spindle Unit)	1b/14 400 yd	0.029 03

Table 2 Constants for Indirect Count Systems
(Clause 9.1.8)

SI No.	Yarn Count System	Unit of Length Used	Unit of Mass Used	Unit of Yarn Count	Constant C_2
(1)	(2)	(3)	(4)	(5)	(6)
i)	Cotton (English)	840 yards (hank)	1 pound	840 yd/lb	590.5
ii)	Linen (wet spun)	300 yards (lea)	1 pound	300 yd/lb	1 654
iii)	Spun silk	840 yards	1 pound	840 yd/lb	590.5
iv)	Woollen (Dewsbury)	1 yard	1 ounce	yd/oz	31 000
v)	Woollen (Yorkshire)	256 yards (skein)	1 pound	256 yd/lb	1 938
vi)	Worsted	560 yards (hank)	1 pound	560 yd/lb	885.8

9.2 Weft Yarn

Determine the crimp and linear density of the weft yarn by taking the test specimens T₁, T₂, T₃, T₄ and T₅ and following the procedure similar to the one prescribed in 9.1.1 to 9.1.8.

9.3 In case the determination of the crimp of the yarn in the fabric is not required and only the linear density is to be determined, the straightened length and mass of the yarn after desizing may be used for calculating the count.

10 REPORT

10.1 The report shall include the following information:

- a) Type of test sample;
- b) Average crimp percent; and
 - 1) Warp
 - 2) Weft
- c) Average count.
 - 1) Warp
 - 2) Weft

ANNEX A (Clause 2)

LIST OF REFERRED INDIAN STANDARDS

IS No.	Title	IS No.	Title
IS 232 : 2020	Glossary of textile terms — Natural fibres (<i>third revision</i>)	IS 6359 : 2023	Method for conditioning of textiles (<i>first revision</i>)
IS 3689 : 1966	Conversion factors and conversion tables for yarn counts	IS 9068 : 2021	Textiles — Quantitative chemical analysis — General principles of testing (<i>first revision</i>)
IS 3919 : 1966	Methods for sampling cotton fabrics for determination of physical characteristics		

ANNEX B
(Clause 9.1.6)

TREATMENTS TO REMOVE SIZING AND OTHER FINISHING MATERIALS FROM THE SPECIMENS OR THE YARNS REMOVED FROM THEM

B-1 If the type of finishing material used is known, follow the method as recommended in IS 9068.

B-2 In case the type of finishing material is not known, proceed as follows:

- a) Extract the specimens/yarns with benzene: methyl alcohol mixture in 3 : 2 ratio in a Soxhlet apparatus for 2 h at a minimum rate of 6 cycles per hour. (This removes oils, fats, waxes, certain thermoplastic resins, etc);
- b) Extract the specimens/yarns with ethyl alcohol in a Soxhlet apparatus for 2 h at a minimum rate of 6 cycles per hour. (This removes soaps, cationic finishes, etc);
- c) Treat the specimens/yarns with 200 ml of water at 50 °C for 30 min, stirring occasionally with glass rod or mechanically. Rinse thrice with fresh portions of warm water (at 50 °C) and dry. (This removes water soluble materials); and
- d) Immerse the specimens/yarns in 200 ml of 0.1 N hydrochloric acid at 80 °C for 25 min, stirring gently every 3 min. Rinse thoroughly with water at 80 °C containing a few drops of ammonia and then finally with plain water. Remove excess water from the sample by squeezing or suction centrifuge and allow to dry. (This removes starches/amino aldehyde compound resins).

ANNEX C
(Clauses 3.1 and 9.1.2)

STRAIGHTENING TENSIONS

C-1 In the absence of instructions to the contrary, the tension to be used to straighten the yarn/thread after removal from the fabric is given in Table 3

Table 3 Requirement for Straightening Tensions
(Clause C-1)

Sl No.	Yarn	Linear Density, tex	Straightening tension, cN*
(1)	(2)	(3)	(4)
i)	Cotton Spun	7 tex or finer Coarser than 7 tex	$0.75 \times (\text{tex value})$ $0.2 \times (\text{tex value}) + 4$
ii)	Woollen and worsted spun	10 tex to 60 tex Above 60 tex to 300 tex	$0.2 \times (\text{tex value}) + 4$ $0.07 \times (\text{tex value}) + 12$
iii)	Man-made continuous filament non-textured	All	$0.5 \times (\text{tex value})$

*1cN \approx 1 gf

ANNEX D
(Foreword)

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